(19) Europäisches Patentamt
European Patent Office
Office européen des brevets

(11) Publication number: **0 457 210 A1**

(12) EUROPEAN PATENT APPLICATION

(21) Application number: **91107616.4**

(51) Int. Cl.5: **D03C 9/06**

(22) Date of filing: **10.05.91**

(30) Priority: **15.05.90 IT 2030790**

(43) Date of publication of application:
21.11.91 Bulletin 91/47

(84) Designated Contracting States:
BE CH DE ES FR LI

(71) Applicant: **Carrara, Elio**
Via Conte Greppi, 33
I-24024 Cazzano Sant'Andrea (Bergamo)(IT)

(72) Inventor: **Carrara, Elio**
Via Conte Greppi, 33
I-24024 Cazzano Sant'Andrea (Bergamo)(IT)

(74) Representative: **Modiano, Guido et al**
MODIANO, JOSIF, PISANTY & STAUB
Modiano & Associati Via Meravigli, 16
I-20123 Milano(IT)

(54) Shaft for heddle frames made of composite materials.

(57) The shaft for heddle frames comprises a bar (1) on which surface layers (2) made of non-metallic material are associated. The bar (1) and the layers (2) delimit a box-like compartment (3) which is filled with a non-metallic material (4) and is closed, on the side opposite to the bar, by a member (5) which is shaped so as to have anchoring points (6) for heddles.

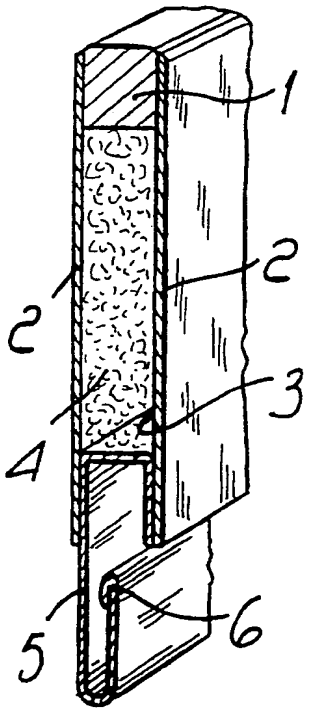


Fig.1

EP 0 457 210 A1

The present invention relates to shafts for heddle frames made of composite materials.

In mechanical weaving looms currently in use, as is known, heddle frames constitute a highly critical component for the perfect execution of the weaving. Heddle frames must furthermore comply with mutually contrasting mechanical requirements; they must in fact be light but resistant to mechanical stresses, they must be wear-resistant and easily interchangeable and must finally have maximum quietness once installed.

A heddle frame is composed of a frame with a substantially rectangular shape which supports, by means of the strips rigidly associated with the cross-members or shafts, the heddles, which are laminae provided, in their median portion, with an eye or slot. The warp threads of the fabric pass within the eyes of the heddles.

Said laminae can slide freely and are hooked, above and below, to said strips which are rigidly associated with the shafts.

The problems of heddle frames, and of shafts in particular, are numerous. The shafts are in fact subjected to heavy dynamic stresses, when the frame moves the warp, and the strips are subjected to considerable wear at the points of contact with the heddles.

The strips are furthermore fixed to the shafts by means of anchoring means which normally are rivets, thus providing the premises for critical points for the breakage of the strips and of the shafts themselves.

The shafts are generally made of extruded aluminum and the strips are made of steel having, in the heddle sliding region, a wear-resistant surface treatment.

Heddle frames must therefore withstand heavy dynamic stresses. In order to respond to these stresses, so far the structure of the heddle frame has been stiffened by increasing the transverse dimensions of both the shafts and the uprights or brackets, and by designing the internal structure of the extruded element so as to increase the supporting ridges of the structure. These constructive methods have only increased the performance of heddle frames to a very small extent, without solving the problem completely, especially in very high speed applications.

The aim of the present invention is to eliminate or substantially reduce the disadvantages described above in known types by providing shafts for heddle frames made of composite materials.

Within the above aim, an object of the present invention is to provide shafts for heddle frames which increase resistance to dynamic stresses by having an innovative geometry while maintaining full compatibility and interchangeability with the heddle frames currently in use.

Not least object of the present invention is to provide shafts for heddle frames which are relatively easy to manufacture at competitive costs.

This aim, these objects and others which will become apparent hereinafter are achieved by shafts for heddle frames made of composite materials according to the invention, characterized in that they are composed of a bar on which surface layers of non-metallic material are fixed, said bar and said layers delimiting a box-like compartment which is filled with non-metallic material and is closed, on the side opposite to said bar, by at least one element defining anchoring points for heddles.

Further characteristics and advantages of the invention will become apparent from the description of a preferred but not exclusive embodiment of shafts for heddle frames made of composite materials according to the invention, illustrated only by way of non-limitative example in the accompanying drawings, wherein:

figure 1 is a transverse sectional view of a shaft for heddle frames according to the invention;
figure 2 is a transverse sectional view of a shaft for heddle frames according to the invention;
figure 3 is a transverse sectional view of a shaft for heddle frames according to the invention;
figure 4 is a transverse sectional view of a shaft for heddle frames according to the invention;
figure 5 is a transverse sectional view of a shaft for heddle frames according to the invention;
figure 6 is a transverse sectional view of a shaft for heddle frames according to the invention;
figure 7 is an enlarged view of a detail of the shaft of figure 6;
figure 8 is an elevation view of a coil of filament winding;
figure 9 is an elevation view of brackets obtained from the coil of figure 8;
figure 10 is a transverse sectional view of a shaft for heddle frames according to the invention;
figure 11 is an enlarged view of a detail of the shaft of figure 10;
figure 12 is an elevation view of a heddle frame provided with shafts according to the invention; and
figure 13 is a transverse sectional view of a further embodiment of the shaft.

With reference to figure 1, a shaft for heddle frames made of composite materials, according to the invention, is composed of a bar 1 on which surface layers 2 made of a non-metallic material are fixed. The bar 1 and the layers 2 delimit a box-like compartment 3 which is filled with non-metallic material 4. The box-like compartment 3 is closed, on the side opposite to the bar 1, by a monolithic strip 5 which is shaped so as to have anchoring points 6 for heddles.

The bar 1 is made of pulverized extruded material or of extruded aluminum and is shaped (see figure 4) so as to have grooves or recesses 7 for providing couplings to anchoring points for connection to the textile machine or couplings of other kinds.

The surface layers 2 are made of composite materials, (e.g. carbon fibre); the material 4 which fills the box-like compartment 3 is constituted by material which is foamed or preformed or injected into said box-like compartment 3.

The monolithic strip 5 is obtained by bending an aluminum or steel lamina or by extruding aluminum, and has a curled portion 9 which is inserted between the surface layers 2.

In figure 2, the anchoring points 6 are constituted by a lamina 8 which is fixed to the monolithic strip 5 by means of either welding or brazing or is made monolithically.

In figures 3 and 4, the monolithic strip 5 is shaped differently and does not have a curled portion 9 between the layers 2 but connects the inner surfaces of the box-like compartment 3.

Each one of figures 5, 6 and 10 is a view of a shaft for heddle frames made of composite materials, which is composed of a bar 10 on which shaped surface layers 11, made of composite material, are fixed. The bar 10 and the layers 11 delimit a box-like compartment 12 which is filled with non-metallic material 13 and is closed, on the opposite side with respect to said bar, by shaped portions which are defined in the surface layers 11 and define anchoring points 14 for the heddle supporting strips.

The materials used in this other embodiment of a shaft according to the invention are the same ones described above.

In particular, in figure 5, the shaped portions are defined on one of the layers 11 which constitute the composite material (e.g. carbon fibre); a seat 16 is defined between the layers 11 for a bar 17, which is made of a metal such as aluminum, steel or the like, and remains enclosed within the layers 11 by means of continuous and monolateral anchoring points 14. In this embodiment, the composite material (e.g. carbon fibre) is furthermore folded so as to define a hook 18 which constitutes the anchoring points. The terminal portion 19 of the hook 18 is provided with a rim 20, figure 7, made of wear-resistant material, so as to reduce friction with the heddles.

For heddles with double hooks, a shaft provided with an anchor having a bilateral tooth 23 is illustrated in figure 10. In this shaft, the terminal shaped portion of the carbon fibre material delimits a cavity 21 within which a bar 22, made of a metal such as aluminum, steel or the like, is inserted. The surface of the twin tooth 23 thus obtained is coated with appropriate wear-resistant treatments. Each heddle, as illustrated in figure 11, must have a tongue-like hooking point 24 in order to engage the double tooth 23.

As illustrated in figure 13, in order to avoid rotation of the heddle, the carbon fibre defines a seat 30 with complementarily inclined teeth 31 which act as support for a twin-toothed hook 32 which, by having a complementary configuration, couples to the teeth 31.

By means of the shafts described above it is possible to manufacture heddle frames of the type illustrated in figure 12. Said heddle frame is composed of an upper shaft 24 which has two separators 27 and two couplings 28 for motion transmission. The shafts 24 and 26 are mutually connected by means of lateral brackets 29 made of filament winding.

The shafts 24 and 26 are provided with different heights, so as to advantageously minimize the deformations caused by the distribution of the dynamic loads. In particular, the height of the upper shaft 24 is greater than that of the lower shaft 26.

Another measure for further reducing the deformations due to the dynamic stresses is to provide both shafts with variable profiles, i.e. to increase the height of the cross-section of the shaft from its ends toward its center, obtaining an outer profile of the shafts which resembles a catenary. The cross-section increase affects the side opposite to the continuous anchoring region.

The brackets 29 made of filament winding are obtained by means of a method illustrated in figures 8 and 9. The filament winding is wound on a spindle so as to obtain a cylinder 30. Said cylinder is sliced with appropriate thicknesses so as to obtain rings which are cut further to obtain the brackets 29. By means of this method it is possible to also provide the above described bars 1 and 10.

The bars 1 and 10 may be obtained not only from filament winding or from extruded aluminum but also from pulverized extruded materials.

The invention thus conceived is susceptible to numerous modifications and variations, all of which are within the scope of the inventive concept. All the details may furthermore be replaced with other technically equivalent elements.

In practice, the materials employed, as well as the dimensions, may be any according to the requirements.

Where technical features mentioned in any claim are followed by reference signs, those reference signs have been included for the sole purpose of increasing the intelligibility of the claims and accordingly, such reference signs do not have any limiting affect on the scope of each element identified by way of example by such reference

signs.

Claims

1. Shaft for heddle frames made of composite materials, characterized in that it comprises at least one bar on which surface layers of non-metallic material are fixed, said bar and said layers delimiting a box-like compartment which is filled with non-metallic material and is closed, on the side opposite to said bar, by at least one element defining anchoring points for heddles.

2. Shaft according to claim 1, characterized in that said at least one element defining said anchoring points comprises a monolithic strip.

3. Shaft according to claim 1, characterized in that said surface layers of non-metallic material comprise shaped surface layers having shaped portions, and in that said at least one element defining said anchoring points comprises said shaped portions of said surface layers.

4. Shaft for heddle frames, according to claim 1, characterized in that said bar is made of pulverized extruded material.

5. Shaft for heddle frames, according to one or more of the preceding claims, characterized in that said bar is made of extruded aluminum.

6. Shaft for heddle frames, according to one or more of the preceding claims, characterized in that said bar is made of filament winding.

7. Shaft for heddle frames, according to one or more of the preceding claims, characterized in that said surface layers are made of carbon fibre.

8. Shaft for heddle frames, according to one or more of the preceding claims, characterized in that said monolithic strip is provided by means of bendings performed on metal laminae.

9. Shaft for heddle frames, according to one or more of the preceding claims, characterized in that said monolithic strip is provided by means of an extruded aluminum element.

10. Shaft for heddle frames, according to one or more of the preceding claims, characterized in that said anchoring points are protected by means of wear-resistant reinforcement treatments.

11. Shaft for heddle frames, according to one or more of the preceding claims, characterized in that said non-metallic material for filling said box-like compartment is a preformed foamed material to which said bar and said surface layers are fixed.

12. Shaft for heddle frames, according to one or more of the preceding claims, characterized in that said non-metallic material for filling said box-like compartment is foamed material injected into said box-like compartment.

13. Shaft for heddle frames, according to one or more of the preceding claims, characterized in that said surface layers are made of composite material shaped and folded without joints.

14. Shaft for heddle frames, according to one or more of the preceding claims, characterized in that said shaped portions and said folded portions constitute said heddle anchoring points.

15. Shaft for heddle frames, according to one or more of the preceding claims, characterized in that said shaped portions delimit cavities within which metallic strips are inserted.

16. Heddle frame, characterized in that it comprises shafts made of composite materials which are mutually connected by means of brackets, said shafts having different heights.

17. Heddle frame according to the preceding claim, characterized in that an upper shaft has a greater height than the lower shaft, said lower shaft having couplings for connection to means for transmitting the motion of the textile machine or of the weaving loom.

18. Heddle frame according to one or more of the preceding claims, characterized in that said shafts have a profile shaped essentially like a catenary on the side which is opposite to the heddle anchoring points.

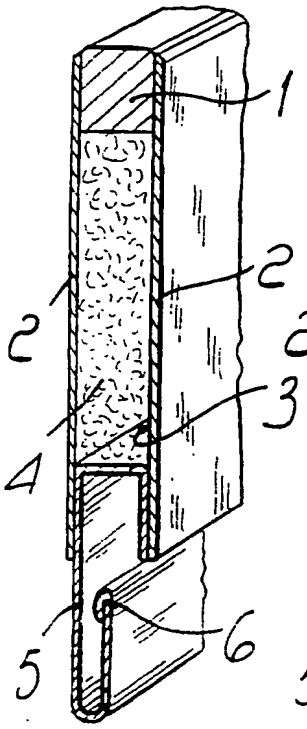


Fig.1

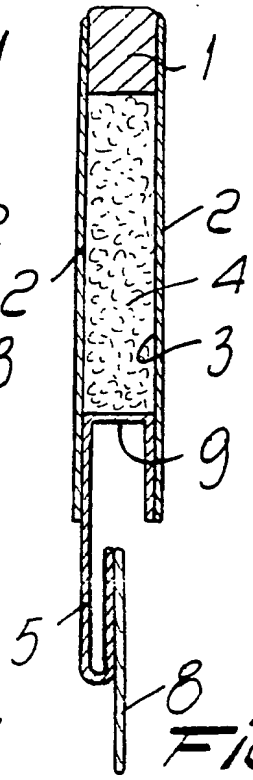


Fig.2

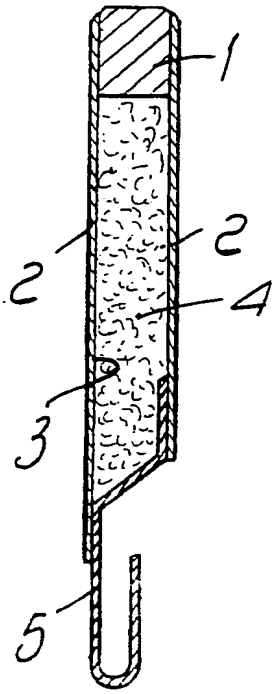


Fig.3

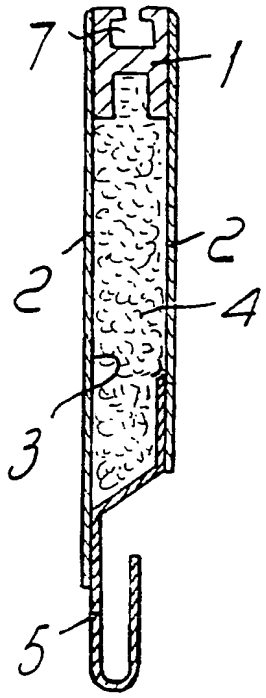


Fig.4

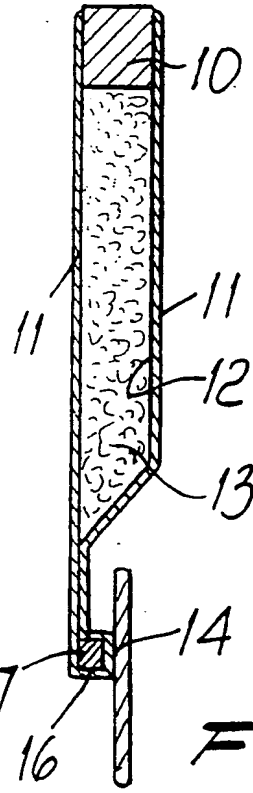


Fig.5

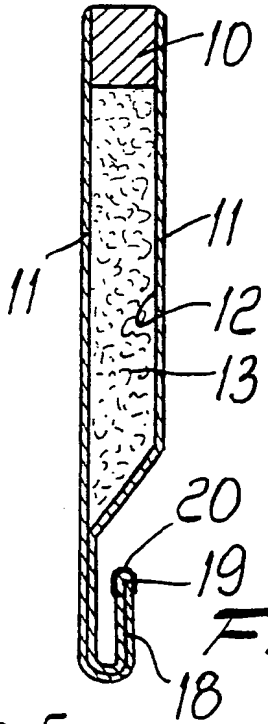


Fig.6

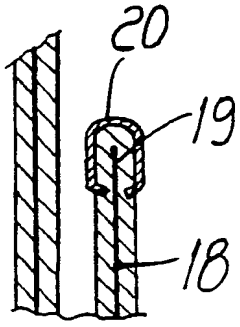


Fig.7

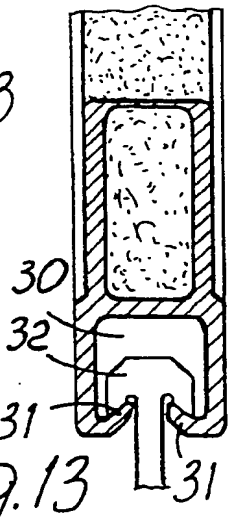


Fig.13

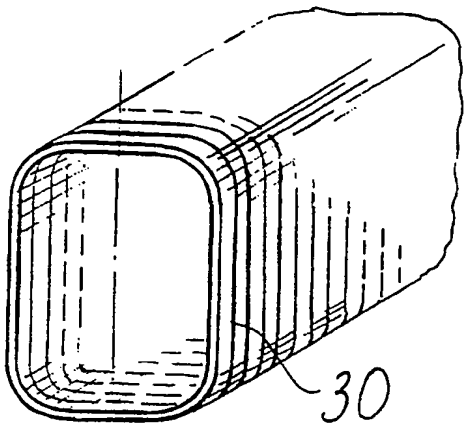


Fig. 8

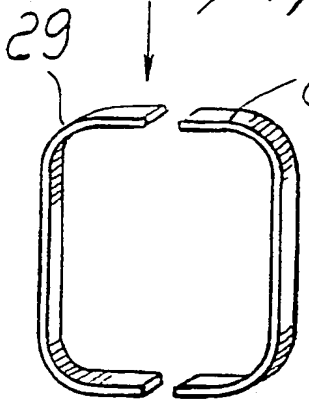


Fig. 9

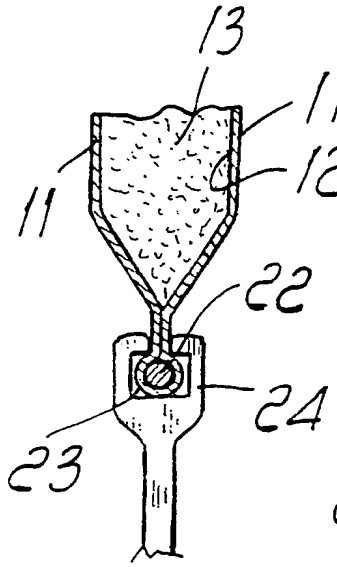


Fig. 11

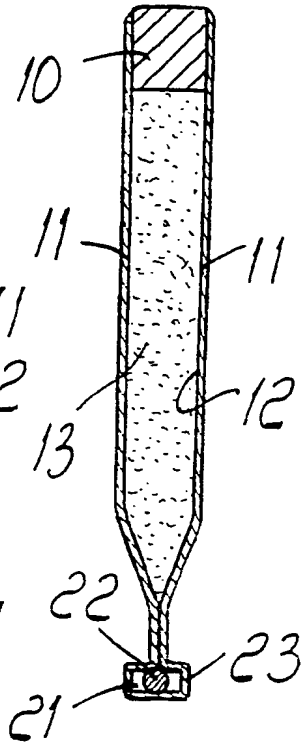
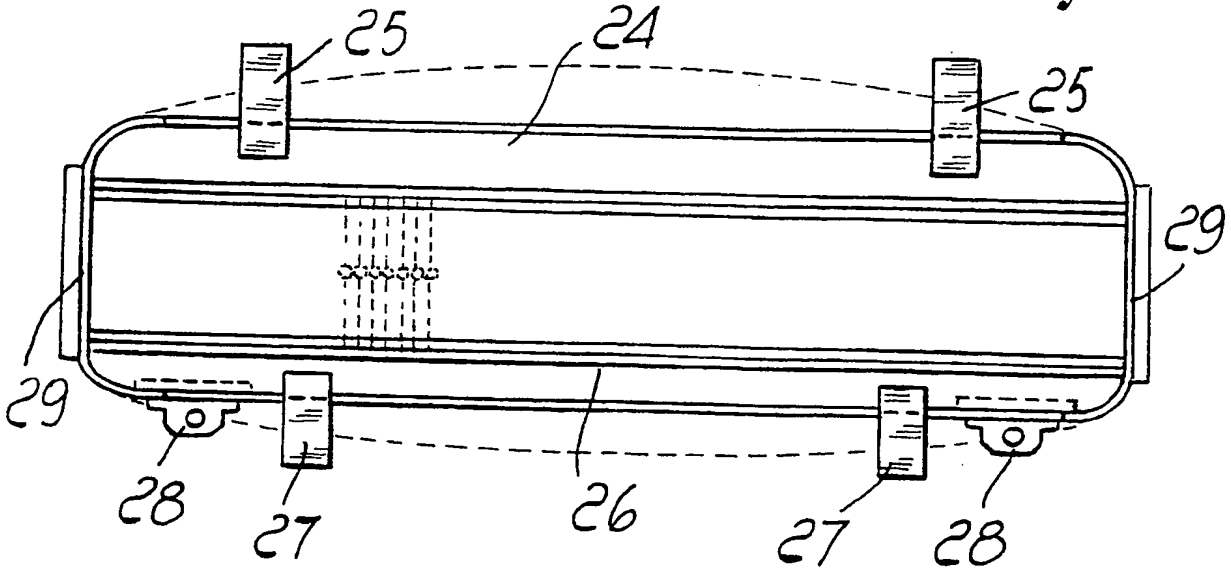


Fig. 10

Fig. 12



European Patent Office

EUROPEAN SEARCH REPORT

Application number

DOCUMENTS CONSIDERED TO BE RELEVANT

EP 91107616.4

Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (Int. Cl.5)
A	US - A - 4 484 604 (KRAMER et al.) * Totality * --	1,3,4, 7,10, 13,16	D 03 C 9/06
A	US - A - 4 901 767 (KOCH) * Fig. 3-5; claim 5 * --	1,11, 12,16	
A	US - A - 4 844 130 (BLONTROCK) * Fig. 10,11 * --	1,4, 11,12, 16	
A	EP - A2 - 0 302 798 (STEEL HEDDLE MFG.) * Totality * --	1,16	
A	US - A - 3 348 580 (KOCH) * Column 2, lines 31-35 * ----	16,18	

TECHNICAL FIELDS SEARCHED (Int. Cl.5)

D 03 C 9/00

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
VIENNA	25-06-1991	BAUMANN

CATEGORY OF CITED DOCUMENTS

X : particularly relevant if taken alone
Y : particularly relevant if combined with another document of the same category
A : technological background
O : non-written disclosure
P : intermediate document

T : theory or principle underlying the invention
E : earlier patent document, but published on, or after the filing date
D : document cited in the application
L : document cited for other reasons

& : member of the same patent family, corresponding document

EPO Form 1503 03.82